Domestication of Indian Catfish, Clarias batrachus by Hormonal Treatment and Manipulation of Thermo-photoperiodism

[1]Shailendra Sharma , [2]D.K.Belsare, [3]Vibha Dave, [4]Rajendra Chaurasia

[1]Department of Biotechnology, Adarsh Institute of Management & Science Damnod (M.P.) India
[2]Former Prof & Head Bioscience Deptt., Barkatullah Univ, Bhopal, India
[3]Department of Zoology, P.M.B.Gjarati Science College Indore- 452001, India
[4]Department of Zoology, Govt. Holkar Science College Indore- 452017, India
Email: shailendra.b.sharma@gmail.com, d.belsare@yahoo.com

Abstract: "Fish being a valuable and easily accessible source of food, its pursuit and capture, constituting the fisheries, are of great importance", The wealth of India (1962). Fish culture in fresh waters not only includes the maintenance, feeding, breeding, growth and stocking, but it also reflects the quantity and quality of the fish and their economic production (Huet, 1970). Thus, inland fisheries have a vital role in the economic progress and as a distinct sector of economy. Their benefits are production of food, contribution to national income, employment opportunities, recreation and sports (Rao, 1966). The pollution and various human activities have caused the destruction of natural spawning and fry grounds contributing largely to the reduction in fry catch. A few species are bred in captivity and their spontaneously breeding under captive condition & the time of spawning are often not predictable. The problems such as viability of naturally spawned eggs and technical difficulties in egg and larvae collection are constraints to mass-scale fry production and dissemination of pathogens, imbalance of natural ecosystems, genetic pollution etc. The technology of manipulation of thermo-photoperiodism with treatment of melatonin is successfully used in domesticating of fish production. The present investigation reports maintenance of brood stock of Indian catfish, Clarias batrachus under controlled conditions and their breeding schedule irrespective of seasons.

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Introduction

Domestication of fish means its direct involvement with man and who has control over breeding so much so that the fish are significantly changed in behaviour and/or appearance. It has become necessity for aquaculture production, because we face numerous problems of culturing fish. The wild fry from natural sources are insufficient to supply the requirements for culture. It is dependent on the season and fluctuates with environmental and climatic conditions. The pollution and various human activities have caused the destruction of natural spawning and fry grounds contributing largely to the reduction in fry catch. A few species are bred in captivity and their spontaneously breeding under captive condition & the time of spawning are often not predictable. The problems such as viability of naturally spawned eggs and technical difficulties in egg and larvae collection are constraints to mass-scale fry production and dissemination of pathogens, imbalance of natural ecosystems, genetic pollution etc.

The technology of manipulation of thermo-photoperiodism with treatment of melatonin is successfully used in domesticating Atlantic Salmon (Salmo salar), Rainbow Trout (Onchorhynchus nerka) , Milk Fish (Chanos chanos) and the production of these fishes reached 100,000 tonnes in Europe. The hormonal cascade used is hypothalamo-pituitary system (synthetic GTRHI & II with or without anti-dopamine drug) and pineal hormone, melatonin. The latter acts a 'conductor' that triggers the timing of daily and annual functions in fish. It is a powerful antioxidant and helps to remove oxidative stress in fish. This important observation has opened up new area to maintain and treat brood stock under controlled conditions. The present investigation reports maintenance of brood stock of Indian catfish, Clarias batrachus under controlled conditions and their breeding schedule irrespective of seasons.

Material and methods

Brooders of Clarias batrachus were obtained from the local market during July-August in ripe conditions. They were maintained under controlled photoperiod and temperature regime in indoor fiber glass tanks (3 m x 2 m with a depth of 0.5 m) with a centrally located partition. Natural light was allowed to enter the building via plastic corrugated roofing

and to provide variable light intensity according to the external conditions and the time of the day. The covers of tanks are made of fine mesh netting to prevent escaping of fish. They were fed with standard diet prepared out of soya based extruded feed, rice and vegetables mixed with slaughter house waste

Experimental design

Before conducting experiments, the catfish were starved for twenty-four hours. In each tank 25 brooders (male and female separately) were kept and were given melatonin injection (0.5ml/kg) in the morning hours intra-peritoneal to set their biological clock. The treatment was based on randomized block design.

During first year the brooders of wild stock were treated with controlled photoperiod and temperature regime for 30 days before the onset of monsoon. They were used for hormonal treatments 30 days after keeping under photoperiod and temperature regime. Schedule of hormonal treatment was HCG - 1000 I.U. to female and 500 I.U. to male.

Experiment 1. providing natural conditions of light (12 hr day and 12 hr night) and temperature 25-27 0C) for sixty days.

Experiment 2. Providing continuous (24 hrs) illumination and temperature of 25-27 OC for 60 days. The continuous illumination is supplied by cool white fluorescent tubes suspended 1 m above the tanks, providing light intensity of approximately 1000 lux over the water surface.

The first set of experiments was conducted during August-September. The biological clock brooders was set by injection of melatonin (0.5 ml/kg). The experiments were conducted in triplicate. The maturity or gravid condition of fish was tested by examining their swollen belly or gentle massaging their belly in order to ooze out ova or milt. The fish were injected with HCG.

The brooders developed by this procedure were used for breeding programme to obtain maximum fingerlings production during spawning. The fingerlings so obtained were kept in controlled condition till they attained adult ripe stage. They were treated with melatonin and 50% of them were kept in natural condition of light (12 hr day and 12 hr night) and temperature 25-27 0C) and the rest in continuous (24 hrs) illumination and temperature of 25-27 OC for 60 days.

The second generation of fingerlings so obtained was raised under standard diet to the adult brooder stage. They were injected with melatonin and HCG.

Results and Discussion

After first experiment, the brooders were striped for ova and milt for fertilization in vitro. The eggs were kept in hatchery (in glass aquaria) and hatchlings were developed to fry in nursery and fingerlings in rearing ponds. After attaining adult stage, they were transferred to earthen ponds (20 m x10 m size) to develop into brooders. These treated brooders spawned after injecting HCG in August. The next generation of brooders so raised under controlled conditions spawned after pituitary extract injection even during November –December. These domesticated catfish were used for subsequent spawning during “natural pre-spawning period”.

Early puberty affects in particular males in commercially farmed Indian fin-fish species such as Major Carps (Catla catla, Labeo rohita, Cirrhinus mrigala) etc. The precocious puberty is a male-biased phenomenon (Belsare, 2009). Having said this, it becomes particularly urgent to deal with a problem that is observed with many species when introduced into aquaculture with feed levels that allow rapid growth, namely the precocious start of puberty. This phenomenon is particularly relevant and observed rather early during ontogenesis in males in these species, probably is related to the lower energy requirements of male compared to female gonad maturation. In many finfish species introduced in aquaculture, the process of sexual maturation adversely affects somatic growth, resulting in reduced growth and feed conversion, and the potential problem of unwanted genetic impacts on wild stocks. In context with the above-mentioned problems brought about by puberty, it can lead to the loss of a large proportion of males before the animals have reached a marketable size (Schultz and Goos ,1999, Hansen et al., 2000).

This technology is successfully used in European fin fishes, like Pikeperch (Sander lucioperca) by Zekes and Szczepkowski (2004) in Poland and Atlantic Salnon (Salmo salar) (King and Pankhurst, N.W. 2007) and Walleye (Stizostedion vitreum) (Malison et al., 1998) in U.S.A.

The idea that melatonin is a “conductor” that triggers the timing of daily and annual functions in fish is gaining interest. However, its modes of action are far from being clearly understood and concern a very limited number of freshwater species. Melatonin is a powerful antioxidant and helps to remove oxidative stress in fish. This important observation has opened up new area to maintain and treat brood stock under controlled conditions so that the fish are domesticated.

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